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COMMONWEALTH PHYTOPATHOLOGICAL NEWS

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M A I N I T E M S

ERWINIA LATHYRI
INTERNATIONAL MEETINGS
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FROM NEAR AND FAR

THE STATUS OF ERWINIA LATHYRI AND RELATED BACTERIA

by D.C. Graham
Department of Agriculture for Scotland,
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Erwinia lathyri (Manns & Taubenhaus) Holland may be formally described as a Gram negative, peritrichously flagellated bacillus belonging to the Enterobacteriaceae, having as one of its most distinctive characters the ability to produce a yellowish pigment on many media. On numerous occasions in the past, E. lathyri has been credited with causing various plant diseases. The organism was first recorded by Manns and Taubenhaus in 1913, who believed it to be the causal agent of streak disease of sweet peas. Later, it was considered the cause of streak disease of tomato and chocolate spot of broad bean. The first two are now known to be virus diseases and chocolate spot is caused by Botrytis spp.

Most workers now agree that the bacterium is a saprophyte, and that its natural habitat is most probably the soil, on plants and plant debris. As a result, it is frequently found amongst the organisms isolated from lesions induced by true parasites on many kinds of plants. I have obtained it from black leg lesions on potato stems, soft rots of potato tubers, tomato, celery and cauliflower, from halo blight lesions on French bean, and from healthy leaves of Narcissus. It has also appeared on salicin-bile salt agar plates inoculated directly with soil suspensions, but not all strains grow on this medium.

Although now discredited as a pathogen, E. lathyri occurs so commonly it is worth describing its biochemical characteristics some of which I have recently recorded. It has a coliform type of metabolism, producing acid rapidly from a large number of sugars, sugar alcohols, and glycosides, but without formation of gas. All strains liquify gelatin slowly, do not liquify pectate gel, and produce small amounts of 2-ketogluconate from gluconate. Most strains give a positive test for nitrate reduction and form acid in ethyl alcohol agar, while a few produce indole. The methyl red test is usually negative and the Voges-Proskauer test positive after five days' growth in ordinary glucose-phosphate-peptone medium,

but some strains give reverse reactions.

When searching for a bacterial pathogen, especially where non-selective media are used for isolation, E. lathyri is quite likely to be found. Furthermore, although with experience colonies of E. lathyri can be distinguished from those of Xanthomonas it is usually necessary to carry out biochemical tests to confirm the identity of the organisms. For example, the writer was examining seakale root showing characteristic symptoms of infection with X. campestris, and yellow colonies appeared in almost pure culture on the isolation plates. However, investigation showed that the organism formed acid in salicin-basal salt media, and did not produce the honey-coloured slimy growth on sterilized potato characteristic of Xanthomonas. Further tests confirmed it to be E. lathyri - probably the true pathogen had already died out in the seakale before isolation was attempted. When dealing with soft rot diseases it is always advisable to check the pectolytic capacity of these yellow organisms, since chromogenic strains of Pectobacterium carotovorum occur occasionally. E. flavida (Fawcett) Magrou may be one of these.

It is noteworthy that E. lathyri is no longer described in Bergey's Manual of Determinative Bacteriology (7th edition, 1957) because of its doubtful taxonomic position. Any worker using the manual will not, therefore, be able to identify this organism although Skerman's artificial key will lead him to "probably Erwinia".

Other yellow pigmented species

A number of other pigmented Erwinia species are reported in the literature as causing plant diseases. These organisms have been given specific status depending on the plant from which they were originally isolated, without any previous comparative studies, and include E. ananas Serrano; E. cassavae (Hansford) Burkholder; E. citrimaculans (Doidge) Magrou; E. mangiferae (Doidge) Bergey et al.; E. milletiae (Kawakami & Yoshida) Magrou; and E. vitivora (Baccarini) Du Plessis. Their pathogenic properties are somewhat doubtful. For instance, Serrano claimed he could induce typical rotting of pineapple fruit with cultures of E. ananas. However, in practice it is possible to produce a variety of symptoms merely by "inoculating" fruit with a sterile needle. This is owing to the presence of organisms in the nectary ducts, blossom cups and even in the glands of the fruitlet. The process of inoculation releases the bacteria from the tissues in which they are normally confined and introduces them into the fleshy part of the fruit where they can grow. It is therefore impossible to be sure whether the symptoms develop from organisms intentionally introduced or from those present on the tissues by chance.

Culturally and biochemically all these Erwinia species seem indistinguishable from strains of E. lathyri, while the pigments appear to be of the same nature. Recently I have compared the pigments of a number of Hawaiian strains of E. ananas with those of E. lathyri. They are xanthophylls, and can be extracted readily from moist cells by refluxing with methanol, but it is not possible to dissolve them out directly with other carotenoid solvents such as diethyl ether, chloroform, petroleum ether or carbon disulphide. The absorption spectra of the pigments from E. ananas and E. lathyri are very similar if not identical, although the colouring matter from a yellow strain of Pectobacterium carotovorum is quite distinct. The nature of the pigments strengthens my view that E. ananas is merely a strain of E. lathyri, as are probably all the other species. In the circumstances, it would be worthwhile re-examining the various diseases with this in mind. Possibly the true pathogen has not been detected, as was certainly the case with cassava leaf spot. This is now known to be caused by X. cassava Wiehe & Dowson, and not E. cassavae.

Other organisms which may belong to E. lathyri are the yellow chromogenic coliforms which have long been known to dairy bacteriologists and have been identified as Aerobacter aerogenes or A. cloaceae. Since these workers are dealing with material which may be contaminated directly or indirectly with soil and plant bacteria it is not surprising that such organisms are found from time to time. I have examined one such isolate, received as A. cloaceae. Apart from its capacity to produce gas from sugars it is biochemically like E. lathyri, and its pigment is a xanthophyll with properties similar to that of E. lathyri. Obviously it would be advantageous if there was more opportunity for exchanges of views between plant

bacteriologists and those working in medical, dairy and other fields. At least it would help to clear up some of the confusion that exists regarding the nomenclature and taxonomy of the plant bacteria.

DETERIORATION OF GLASSWARE IN THE TROPICS

by R.N. Hilton
Rubber Research Institute, Malaya

Although it is generally known that cameras and microscopes must be kept dry, nothing appears to have been written on the nature of the deterioration of glass apparatus in the tropics and how to prevent it until Mr. Dade's article on this topic in the April issue of C.P. NEWS. This must have been as interesting to other workers in the tropics as it was to us in the Pathological Division of the Rubber Research Institute of Malaya. It may be of interest to others to know what routine precautions we have been taking over the past ten years, successfully, but often without knowing the scientific basis for them.

The whitening in storage of microscope slides, cover glasses, measuring cylinders, and soda-glass apparatus long puzzled us and was put down to "devitrification". In some books it is stated that the white deposit can be removed by soaking the glassware in a 5 per cent. aqueous solution of sodium metasilicate. We have found only hydrofluoric acid to work. As much of the price of glassware lies in carriage we now buy Pyrex glassware which does not suffer from this defect under our laboratory conditions. The custom some makers have of packing microscope slides for tropical use in acid alcohol is quite unnecessary as dry slides are easier to pack, and any laboratory can provide acid alcohol to store them in on arrival. We always put slides and cover glasses, whether in store or on the bench, straight into 70 per cent. alcohol to which a few drops of hydrochloric acid have been added.

Many people have spoilt their cameras or binoculars by sealing them away hermatically. The best advice to those with no special facilities is to take advantage of periods of low humidity, and open their optical instruments for a few hours in the middle of the day. We have kept microscopes on a glass plate on the bench, under bell jars with ground glass edges. A jar of calcium chloride is put in as a desiccant, this having to be changed less frequently than silica gel. Each microscope has an ordinary desiccator standing by it containing accessories, over calcium chloride. We have not experienced the trouble that is supposed to result from over-drying, endangering the balsam mounts of the lenses, but some recommend quick lime as a milder desiccant.

The advent of the air-conditioned laboratory and store-room has solved these problems, but it will be a pity if the experience gained in running laboratories at relative humidities up to 100 per cent. and temperatures of 70° - 90°F. is lost. Even though the larger research establishments are likely to be air-conditioned, small laboratories and schools will benefit from following the few simple precautions outlined.

VISIT OF THE FRENCH MYCOLOGICAL SOCIETY TO THE C.M.I.

On the morning of Sunday September 7th about thirty members of the French Mycological Society who were holding a joint foray with the British Mycological Society at Reading visited the Commonwealth Mycological Institute. The Assistant Director, Major Dade, and members of the scientific and technical staff attended to explain the work and aims of the C.M.I. The visiting mycologists spent an hour and a half in the herbarium and culture collection and were greatly interested in everything that was shown them. Special interest was shown in the way specimens, slides and dried cultures illustrating the life histories of fungi are all filed away together in the herbarium folders. Slide culture techniques and the drying down of cultures also attracted considerable attention. Specimen copies of the REVIEW OF APPLIED MYCOLOGY and other publications were on show; taxonomists amongst the visitors were particularly interested in the MYCOLOGICAL PAPERS which some of them had not seen before.

FROM NEAR AND FAR

The Institute of Biology, London, is rapidly growing up. It has recently announced in its Journal that the Civil Service Commissioners of the United Kingdom have agreed to recognize the Endorsed Certificate in Biology (ordinary level) as a qualification for the Scientific Assistant grade. The advanced level certificate will also provisionally be accepted for admission to the Experimental Officer/Assistant Experimental Officer grade and the position will be reviewed in two years time.

The formation of a branch of the Institute in Northern Ireland has been approved by Council.

It is notified in the NEWSLETTER of the Mycological Society of America that the national fungus collections of the USDA and the Smithsonian Institution now housed at Beltsville will be transferred to the Department of Botany, Smithsonian Institution, Washington, D.C., within the next two years as space becomes available.

The British Association has moved from Burlington House to the building of the Royal Society of Arts at 18, Adam Street, Adelphi, London, W.C.2.

The National Research Council of Canada has awarded 302 scholarships for the year 1958-9 valued at 414,700 dollars, tenable in Canada and elsewhere including the United States, Great Britain, Belgium, France, Germany, Italy, Sweden, and Switzerland.

The Colonial Development Corporation at the end of 1957 had 76 projects in progress as compared with 66 a year before. There was a record net profit of £732,868 compared with £572,809 in 1956.

The International Council of Scientific Unions expects to move to new headquarters in the former Royal Palace, Noordeinde, The Hague, Holland, at the end of 1958.

The Third Annual Meeting of the New Zealand Microbiological Society was held at Lincoln College on the 14th and 15th May. The meeting was very well attended and the buffet dinner and evening address by Dr. I. Blair on "The Microbiologist and the Law" was most entertaining. The main symposium was on the ecology of fungal diseases of animals and plants. Dr. M.J. Marples dealt with human fungal pathogens, Messrs. Hartley and Russell with animal pathogens, Dr. M. di Menna with soil yeasts, Dr. H. Smith with leaf and stem plant pathogens and Dr. F. Newhook with soil Phycomycete pathogens. The other papers on plant diseases were by H.T. Wenham on stem canker of blue lupins, Joan Dingley on the importance of the perfect stages in fungal classification, Prof. G. Baylis on the effect of mycorrhizas on growth of broadleaf, and by A.B. Lloyd and Dawn Matthews on methods of detecting seed-borne fungal pathogens.

A technique for the inoculation of plants with bacterial pathogens using the "carborundum-rubbing" method in common use with viruses is described by M.A. and J.J. Nour in NATURE, No. 4628, p. 86, July 12, 1958. Advantages over the conventional "damp chamber" method are claimed.

South Africa has recently issued a new periodical the SOUTH AFRICAN JOURNAL OF AGRICULTURAL SCIENCE (Government Printer, Pretoria, 7s. 6d.). It is of a high standard and first class presentation, and will be a valuable addition to the plant pathology library.

The Canada Department of Agriculture's well-known chart of potato tuber diseases has been revised and re-issued in 1958.

THE BOOK OF FLOWERING TREES AND SHRUBS (Whitehead, Frederick Warne, London and New York. 15s. Coloured illustrations). A guide for gardeners and a companion volume to THE BOOK OF GARDEN PLANTS.

Allen and Hanburys, the British pharmaceutical house have won a contract to set up in Iran a £1,000,000 factory to produce pharmaceutical products.

SIXTH INTERNATIONAL CONGRESSES ON TROPICAL MEDICINE AND MALARIA

Lisbon, 5 - 13 September 1958

At first sight these Congresses might appear to include little of interest to plant pathologists. Mycoses of man, however, have always had a reputation for being more widespread and more severe in tropical than in temperate climates and this tradition was one factor which determined the inclusion of a Sub-Section on Mycotic infections in the programme of the meeting. Another factor was the world-wide increase in interest and in understanding of fungus diseases of man and animals during the past twenty-five years.

According to a recent survey by C. M. I., approximately 1, 200 books and papers on medical and veterinary mycology were published during the year 1957. If the mycological standard of some of these papers was lower than that of the average paper on mycotic diseases of plants, that of many others was extremely high; a fact not always appreciated by plant pathologists who might well critically inspect the recent monographs by Littman and Zimmerman on Cryptococcosis, 1956, and by Fiese on Coccidioidomycosis, 1958, with a view to adopting them as models for a similar general purpose treatment of major plant diseases. The best work on mycoses of man and higher animals can no longer be ignored by students of plant disease.

Against such a background 60 to 70 workers in the fields of medical and veterinary mycology met together in Lisbon. There were three official sessions on mycotic infections, the first devoted to clinical and epidemiological aspects, the second and the third to the ecology and saprophytic occurrence and the biochemistry and physiology of pathogenic fungi, respectively. In addition there were two sessions for 'free communications' and during the Congress an excellent film on South American Blastomycosis, produced by Professor da Silva Lacaz of Sao Paulo, Brazil, was shown.

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The second official session opened with a comprehensive review of the ecology of pathogenic fungi by C. W. Emmons which was followed by a series of shorter communications by H. I. Lurie on histoplasmosis in S. Africa, R. O. Egeberg et al. on coccidioidomycosis in California, and E. Beatrix Durie on the culture of dermatophytes from Australian soils. In other papers G. C. Ainsworth dealt with the mouth of man and N. van Uden with the intestinal yeast flora of farm animals as reservoirs of pathogenic fungi. This symposium emphasized how widespread, and particularly in soil, are the fungi which cause disease in man and animals and yet how rarely has a student of soil fungi recognized any such fungi among his isolates.

The two dozen free communications were very diverse. They ranged from studies on serology of yeasts in Japan to the recent spectacular findings by J. C. Gentles in Glasgow that ringworm in experimental animals can be controlled by the administration of griseofulvin by mouth and from an historical review of the contribution of the Scandanavian countries in this field to a report on tinea nigra from Ceylon.

Finally it may be noted that during the week there were two business meetings of the recently formed International Society for Human and Animal Mycology.

G. C. A.

PLANT PATHOLOGICAL RESEARCH IN PORTUGAL

The work of the team of plant pathologists, led by Professor Branquinho d'Oliveira, at the Estação Agronómica Nacional of Portugal is well known. At the moment the Station is being transferred from Sacavem a few miles west of Lisbon to Oeiras, which is situated near Estoril, about a similar distance from the city in a northerly direction. The new site is a farm which was once part of the country estates of the versatile Marquês Pombal, who was mainly responsible for the plan for re-building Lisbon after the earthquake in 1755. It is attractively situated and already a workmanlike series of glasshouses are in use by the Section of Plant Pathology, and nearby are extensive plantings of beans, maize, and rice in connexion with diverse plant breeding programmes. The main building has yet to be erected but of the plant disease work only that on forest trees is still at Sacavem.

The main feature of the current phytopathological investigations is the work on coffee rust (Hemileia vastatrix and H. coffeicola) by the 'Centro de Investigação das Ferrugens do Cafeeiro'. Contacts have been established with the main coffee growing regions throughout the world and large experiment collections have been amassed so that at present there are some 200 strains of the rusts in culture and more than a thousand clones of coffee representing many species and cultivars. These collections have been used to distinguish differences in susceptibility in the host strains and to differentiate a number of physiologic races of the rust. The general pattern of distribution of more than half a dozen of the latter have been determined. In parallel with these studies attempts are being made to breed new types of coffee which combine satisfactory commerical qualities with rust resistance and coffee material which proves of no interest in connexion with rust is held outdoors under slight protection and selected for cold resistance - another character of importance in some countries such as Brazil. C. J. Rodrigues Jr., H. C. Mourão, and Professor Branquinho d'Oliveira are the responsible for the coffee rust work.

Another coffee disease, 'Sudden Death' of coffee in Angola, is under investigation by Mendes Gaspar from whose studies it appears that the condition is associated with root infection by Fusarium oxysporum and by Macrophomina phaseoli.

There is also much work in progress on economic crops of Portugal. Professor

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d'Oliveira's studies on the cereal rusts continue and rusts of forage grasses and flax are also under investigation. Bacterial diseases of potato and olive continue to receive attention while there is particular current emphasis on virus diseases.

Dr. Maria de L. V. Borges is working on virus diseases of potato and is also making a survey of the viruses of tomato in Portugal, which as elsewhere appear to be both widespread and diverse. H. F. Dias is making complementary surveys of viroses of citrus and Prunus and is paying particular attention to the complex of virus diseases or diseases of uncertain etiology which attack the vine.

The above account is based on a brief but intensely interesting visit to Oeiras in September 1958 and in conclusion I should like to thank Dr. Borges and Dr. Rodrigues and their colleagues for their kindness and hospitality.

G.C.A.

OBITUARY

GUY RICHARD BISBY

Dr. G.R. Bisby who died on 3rd September in his 70th year after being an invalid since his retirement from the C.M.I. at the end of 1954 was a native of South Dakota. He graduated from the South Dakota State College and later studied at Columbia University and the University of Minnesota. From 1920 to 1936 he was Professor of Plant Pathology at the Manitoba Agricultural College, Winnipeg, and subsequently Assistant Mycologist at the C.M.I.

Bisby was the author of many papers on diseases of potatoes and other plant pathological topics but he will be best remembered for his contributions to systematic mycology. He was an industrious and indefatigable worker with a rare knack of bringing to a conclusion any project on which he embarked. A notable series of collaborations brought to fruition lists of the fungi of Manitoba, India, and Ceylon; catalogues of British pyrenomycetes, hyphomycetes, and rusts; and the Dictionary of the Fungi. He himself published important contributions to the knowledge of the Hysteriales and while at the Institute he had a special responsibility for the identification of rusts. He also compiled the Institute's first list of tropical plant diseases.

Due to his interest in nomenclature he served on the Special Committee for Fungi of the International Botanical Congress and codified his own not always orthodox views in the very useful little Introduction to the Taxonomy and Nomenclature of Fungi, 1945 (2nd edition, 1953).

Dr. Bisby who had a retiring nature could in later years rarely be enticed from the Institute or his garden. He was, however, a good correspondent with a wide circle of friends and had interests that included chess, archaeology, and the clarinet.

He received a number of honours. He was Vice-President of the British Mycological Society, an Emeritus Member of the American Phytopathological Society, and in 1956 he was awarded a gold medal for outstanding achievement by the University of Minnesota. He will long be remembered by his former colleagues at the Institute who offer their sincere sympathy to Mrs. Bisby.

G.C.A.

P E R S O N A L N E W S

C.M.I. News

The Director attended a meeting in Paris of a working party of the European Plant Protection Organisation to discuss protective measures against the importation of seed-borne tropical plant diseases into Europe and the Mediterranean area.

Dr. Ainsworth attended the mycology section of the Sixth International Congresses on Tropical Medicine and Malaria held in Lisbon in September and visited plant pathology research centres in Portugal.

J. J. Elphick B. Sc. has been appointed to the Culture Collection staff to replace Agnes Brown who left to be married. He was a post-graduate student under George Smith at the London School of Hygiene and Tropical Medicine, where he studied culture collection techniques and particularly fungi of the genera Penicillium and Sporotrichum.

Dr. R. H. Estey of Canada and Mme Nicot of the Cryptogamic Herbarium, Paris, have spent some weeks working in the Herbarium.

Visitors

Among recent visitors to the C. M. I. have been: H. N. and Mrs. Racicot, Ottawa; Elizabeth M. Pengelly, North Africa; Dr. A. C. Jain, Y. P. Shreevastava, B. K. Varma, M. A. Siddiqi, Dr. Govindaswamy, and Professor S. R. Bose, India; M. M. S. Malik and Dr. Abdul Hafiz, Pakistan; Drs. B. A. Revilla and T. Batin, Philippines; P. Panoedjoc and S. Soetantijo, Indonesia; Drs. R. Henry, C. Jacquiot, Yves André, G. Bertram, C. Bergeron, A. Denis, A. Blutel, J. Métron, C. and Mme Zambettakis, France; Louis Imler, Belgium; G. L. van Eyndhoven, Netherlands; I. Eisfelder, Germany; Z. Avizohar, Israel; H. H. Storey and P. J. Greenway, Kenya; R. I. Leather, A. L. Wharton, and D. Dring, Ghana; R. Antoine, Mauritius; B. J. T. Baldwin, Uganda; C. T. Mann and Gloria Lim, Malaya; Paul Surany, New Caledonia and Kenya; A. G. Robertson, Nigeria; G. Wade, Tasmania; J. D. Briggs, Illinois.

Appointments, Promotions, Retirements etc.

Dr. Mary Noble of East Craigs, Edinburgh, has been elected to a fellowship of the Royal Society of Edinburgh.

Brian Webster is now with Compania Shell de Venezuela, Cagua, Edo. Aragua, as head of the Plant Pathology Section of the Shell Co. in Venezuela.

Dr. W. P. K. Findlay of the Forest Products Research Laboratory, Princes Risborough, has been appointed assistant director of the Brewing Industry Research Foundation, Nutfield, Surrey, in succession to Dr. A. H. Cook, who has been appointed director.

R. W. Marsh has been appointed to a readership in plant pathology at the University of Bristol.

Dr. R. V. Harris has been elected a vice-president and president-elect of the Association of Applied Biologists for 1958-9.

Professor F. M. Haines has been elected emeritus professor of botany at Queen Mary College, London.

Royal Society and Nuffield Foundation Commonwealth bursaries have been awarded to Dr. R. H. Estey of the Plant Pathology Department, McGill Univerisity, for studies in new techniques in plant pathology at Nottingham and to Dr. C. E. Wright, of the Plant Breeding Station, Loughgall, N. Ireland, to study blind seed

(continued on p. 62)

OVERSEAS NEWS

NOTES FROM CANADA

RECENT CANADIAN RESEARCH IN THE PHYSIOLOGY AND CHEMISTRY OF WHEAT STEM RUST

by F.R. Forsyth, Winnipeg

Probably the most significant recent development in the study of plant diseases in Canada is the increasing attention being given to host-parasite relations. These studies are primarily concerned with improving our knowledge of wheat stem rust, a disease of great economic importance in Western Canada.

The present program was initiated in 1951. Work was begun initially at the Plant Pathology Laboratory, Winnipeg, now the Canada Department of Agriculture Research Laboratory and, under extra-mural research grants of the Department, at the University of Saskatchewan, Saskatoon, and the University of Manitoba, Winnipeg. Workers at the Prairie Regional Laboratory (P.R.L.) of the National Research Council in Saskatoon began independent studies as did the Chemistry Division of Science Service, Ottawa, and the Department of Plant Pathology, Macdonald College, Quebec. Results of these investigations have been appearing in scientific journals for the past four years. This article is a summary of a large part of the published work.

Biology Department, University of Saskatchewan

Dr. Michael Shaw and his co-workers have published in the CANADIAN JOURNAL OF BOTANY a series of papers on the physiology of host-parasite relations. When stem rust (Puccinia graminis) of wheat and barley, sunflower rust (P. helianthi), and powdery mildew (Erysiphe graminis) of wheat and barley were used in studies on the uptake of radioactive carbon, phosphorus, and calcium they found a rapid and marked accumulation of radioactivity in the infection areas of these obligate parasites. The accumulation was shown to be dependent upon aerobic respiration. Early in their work Shaw and Samborski concluded that the results obtained with the three organisms fully supported the hypothesis that a diffusible substance (or substances), produced when infection occurs, either by the fungus or by the host cell or cells under attack, or both, stimulates the metabolic activity of the host tissue surrounding the infection sites. The rapid transport of radioactive substances toward the infection areas and their accumulation at the sites were considered to be comparable to the accumulation of radioactive substances in meristematic or other rapidly metabolizing regions. The relative rate of transport of metabolites into the infection zone and their utilization within the site were thought to be an important factor in determining both the degree of development of the parasite and the reaction of the host.

The increase in respiration as a result of infection, like the accumulation of radioactive sugars and other substances, was localized at the sites of infection. When the respiration rates on a dry weight or total nitrogen basis were compared for the two species Khapli (resistant) and Little Club (susceptible) it was seen that the rate of the respiratory increase in Khapli was greater than that in Little Club. Moreover the respiratory peak and the secondary decline in respiration occurred sooner in Khapli than in Little Club.

Experiments in which glucose-1-C^{14} and uniformly labelled glucose were fed separately to samples of both healthy and rusted or mildewed tissue showed that the relative contribution of the No. 1 carbon atom of glucose to the total carbon dioxide evolved rises with the progress of development of both mildew and rust. They stated that one explanation of their observations could be that in the diseased tissue there is an increase in the proportion of the respired carbon which passes through an "alternative" respiratory pathway, possibly the hexose monophosphate shunt.

Judging from the work of Shaw and his co-workers, alterations in the level of endogenous indoleacetic acid (IAA) following infection of cereal leaves with rust and mildew could play a role in regulating the mobilization of metabolites at points

of infection of obligate parasites, and in the development of hypertrophy and hyperplasia where these occur as a result of infection.

Shaw's group has suggested that genetic control of resistance, at least where resistance can be broken by experimental manipulations, may be genetic control of the internal factors (e.g., availability and balance of co-factors in the indoleacetic acid oxidase system) which may govern auxin balance.

Prairie Regional Laboratory (P.R.L.) Saskatoon

The P.R.L. group under the guidance of Dr. G.A. Ledingham has studied the respiration and various enzymes of the resting and germinating uredospores of wheat stem rust. Since the rust has not been cultured in the absence of the host it was important to know what are the characteristics of the germinating spore and in particular what biochemical mechanisms the rust may lack.

The enzymes necessary for the breakdown of carbohydrate through the glucose-6-phosphate oxidative pathway were found in the uredospores. In addition the enzymes required for the utilization of glutamic acid and certain other amino acids, when supplied to the germinating spores in the external medium, were found.

The complex sugars (polysaccharides) of the plant might be utilized by the rust for nutrition or as a means of entry into individual cells. Studies showed that the enzymes necessary for splitting the hemicelluloses of both resistant and non-resistant wheat varieties were present in ungerminated rust uredospores.

In summary, these results indicate that the germinating spores have the ability to utilize lipids, proteins, and carbohydrates. This is true even though during germination the lipids and proteins but not the carbohydrates are utilized.

Several research workers have reported that rust uredospores when moistened produce one or more volatile or non-volatile self-inhibitors of germination. The presence of various coumarins and phenolic acids in uredospores was demonstrated, and the effectiveness of these in preventing and stimulating spore germination was tested. A germination stimulator described by other workers could be coumarin, according to this group. The P.R.L. workers suggested that coumarin and phenolic compounds formed by wheat stem rust could play an important part in the physiological effects of rust infection on the host through their effect on indoleacetic acid metabolism. This concept of a role for IAA in the host-parasite relationship of wheat stem rust is in agreement with that of Shaw's group.

Of considerable value to future research in this field was the disoovery that dense, felt-like growths of aerial mycelium of Melampsora lini (flax rust) could be obtained when surface-sterilized, rust-infected cotyledons of flax were put on a modified Knop's nutrient medium. Although the mycelium remains fully dependent on the living host tissue sufficient mycelium could be collected, free from host material, to allow biochemical studies.

Canada Department of Agriculture Research Laboratory, Winnipeg

At the Plant Pathology Laboratory, Winnipeg, the self-inhibition of germination of uredospores of Puccinia graminis was studied. Since viable spores would not germinate in closed Warburg flasks while similar spores in an open container showed a high percentage of germination the inhibitor was thought to be volatile. The similarity of the absorption spectra of the inhibitor and of trimethylethylene (TME) in acetone solutions indicated that TME was the natural inhibitor. Certain metabolic derangements in the area of the infection and the failure of uredospores to germinate in situ may be attributed to this substance.

Khapli (Triticum dicoccum), a highly resistant variety which has been used extensively in studies of host-parasite relations, has been made susceptible to stem rust by a variety of methods. These include treatments with DDT, maleic hydrazide, excesses of zinc, cobalt, and manganese, heat treatment at the bases of the leaves, and detaching the leaves. The metabolic disturbances which occurred in treated plants resulted in considerably increased levels of soluble carbohydrate and amino acids in all instances. It was inferred that the increased levels of substrate were directly responsible for the induced susceptibility.

The effect of the methods of breaking resistance was not specific for one genetic type of resistance to rust. The resistance of Khapli and of several other varieties to a number of races of stem rust was broken. This lack of specificity may sig-

nify that the biochemical basis of resistance is the same qualitatively in several different wheat varieties, but differs quantitatively.

Through co-operative efforts of Drs. C. Person (geneticist), D.J. Samborski (plant pathologist), and F.R. Forsyth (plant physiologist) it was found that benzimidazole was of considerable value in the study of the nature of rust resistance. This chemical at 40-100 p.p.m. in water solution caused detached Khapli wheat leaves to remain green for up to 8 weeks and to retain resistance to stem rust. The major effect of the benzimidazole was the prevention of the rapid proteolysis normally accompanying detachment of a leaf. The resulting low level of amino acids appears to be the cause of the retention of resistance. A concept embodying the principle that the availability of amino acids is of particular importance to rust development has been advanced by these workers. This method of leaf culture should prove to be of value in studying the effect of various metabolites such as carbohydrates and amino acids on the growth of rust in the detached leaf.

Conclusion

Why has so much emphasis been placed on the study of the host-parasite relations of one plant disease, stem rust of wheat? The disease is of great economic importance to Canada but this is only part of the answer. It is realized that however varied its manifestations, life follows a similar pattern (Szent Gyorgyi) and presumably parasitism also does so to a certain degree. Thus, the information acquired about one disease may be helpful in the study and control of other plant diseases.

What has been accomplished? The results already published are an indication of the considerable measure of success achieved. A great deal has been learned about the general nature of rust parasitism, e.g., increases in the movement of materials to the infection, respiration at the infection site, level of IAA in the vicinity of the infection, and the possible role of amino acids in rust resistance. However, we do not have any knowledge of the differences in the biochemical mechanisms of the various races of rust. For the present the races of rust can be assumed to be biochemical mutants and to have specific requirements for successful parasitism. Wheat has biochemical mutants as well. A susceptible reaction is expressed because of the compatibility of the interlocking metabolism of a mutant of rust and of wheat. The biochemical requirements of such compatibility are still unknown.

NEWS FROM NEW SOUTH WALES

Latent Contamination in Relation to Brown Rot of Stone Fruits: There is renewed interest in Australia in attacking the problem of brown rot of canning peaches, following the very severe losses caused by this disease in the 1955-56 season. A joint programme of research has been undertaken supported by funds from the Canning Industry and Governmental sources. Investigations on the disease are in progress in Victoria, Tasmania, New South Wales, in the laboratories of C.S.I.R.O., and some interesting results have already been obtained.

The question of latent infection in peaches has been examined without finality. It is considered probable by many that while latent infection may occur in apricots, it is not a phase of the disease in peaches.

Mrs. S.M. Jerome (JOUR. AUST. INST. AGRIC. SCI., 24, June 1958) has introduced the new thought of latent contamination.

From the practical point of view and considering the tough nature of the conidium (or is it a chlamydospore) of S. fructicola such contamination could be as much a menace as latent infection. Mrs. Jerome concludes that minute ruptures of the epidermis in fruit approaching maturity caused by growth stresses provide an easy entry for the pathogen. Accordingly she suggests that a spraying programme for the control of brown rot may be more efficiently regulated if guided by a forecasting system based on the conidial populations on fruits in selected localities.

Control of Leaf Diseases of Bananas by Low volume Oil Spraying: During the past season a field trial has been carried out in northern New South Wales to test the reported effectiveness of low volume oil spraying in the control of Cercospora leaf spot. Oil treatments with and without an added fungicide have been applied at weekly, fortnightly, and monthly intervals to a plantation of Williams bananas.

The results of this trial have shown that 2 gallons of Esso orchard oil per acre applied from January to May as a mist, with an imported "micronette" machine, reduced defoliation to a level such that it was unlikely to have seriously reduced the quality or yield of fruit. By contrast 2 gallons of oil per acre applied fortnightly as a fog with a "Swingfog" applicator gave negligible control of leaf spot. Weekly fogging although giving some degree of control was quite inferior to a less frequent application of oil as a mist.

Serious leaf loss can occur during the autumn from an associated leaf disease, speckle, and although the exact causal organism is not known, the occurrence of the disease shows some association with red spider (Tetranchyus sp.) activity, especially during dry seasons. Oil applied both as a mist and as a fog was ineffective in reducing the incidence of speckle. The incorporation of 1 lb. zineb per acre with the oil gave an appreciable control of speckle and this has further reduced leaf loss in plants where both leaf spot and speckle occur simultaneously.

C.J. Magee

NEW ZEALAND NOTES

Aerial surveys of turnip crops were carried out by H.C. Smith and T.P. Palmer in Canterbury this autumn by taking photographs with Kodachrome film. These have enabled the general incidence of cauliflower mosaic infection to be determined and infection gradients in particular fields to be studied. The work of Colwell (HILGARDIA, 26: 223-286) in California had previously shown the usefulness of this method for wheat rust and cereal yellow dwarf virus, and it is intended to carry out further aerial photographic surveys to record experimental plots and general field incidence in the coming season for both cereal yellow dwarf virus on wheat and cauliflower mosaic on turnips.

Pinus radiata on New Zealand farms has been badly affected in recent years by a disease involving several species of Phytophthora. Trees have been dying at a more or less steady rate throughout some of the extensive North Island plantations and while Phytophthora spp. may be involved in part, the stiuation as a whole is not yet clear. There are marked similarities to pole blight of Pinus monticola in north-western U.S.A. and little-leaf of P. echinata in the southeast.

Overseas Visit

Dr. F.J. Newhook of the Plant Diseases Division, D.S.I.R., Auckland, spent two months of 1957 visiting several laboratories in the U.S.A. and Canada. The main reason was to discuss diseases of Pinus spp. and other conifers with North American research workers. Numerous other centres were visited and opportunity was taken to present a paper at the annual meeting of the Canadian Phytopathological Society in Vancouver. Breeding of tomatoes for resistance to Cladosporium fulvum was discussed at Vineland (Ontario) and at Waltham (Mass.). On his way home Dr. Newhook discussed the Phytophthora disease of pineapples with officers of the Pineapple Research Station, Honolulu. At Fiji he spent 3 days with Dr. Peter Hutchinson, a former colleague at the Plant Diseases Division, who left to join the University of Jamaica and is now plant pathologist with the Colonial Sugar Refining Co. in Trinidad.

A valuable sequel to the tour has been the return visit of two of the American scientists whom he visited at their home laboratories: Mr. Philip Briegleb, director of the Southern Forest Experiment Station, who was United States observer at the British Empire Forestry Conference in Australia and New Zealand, and Dr. Earle J. Anderson of the Pineapple Research Station, Honolulu, who spent two weeks in New Zealand on his way home from Australia where he had held a Fullbright Fellowship.

Personal News

John Allen has arrived at Plant Diseases Division, Lincoln, to take up his appointment as mycologist after seven years in Nigeria with the W.A.I.F.O.R. He will specialize in seed-borne diseases of field crops particularly those of onions, peas,

and brassicas.

Dr. R. E. F. Matthews will attend the thirty-third meeting of the Australian - New Zealand Association for Advancement of Science at Adelaide on 20-23rd August as the representative of the Plant Diseases Division, D. S. I. R. He will study research work at Melbourne and Sydney on viruses and nucleic acids.

Mr. I. Cruickshank of the Microbiology Department of the Division of Plant Industry, Canberra, came to Lincoln during a short visit to New Zealand. He is continuing the work of Dr. H. Mueller on the role of chemicals produced in plants in response to disease invasion.

NOTES FROM PAPUA AND NEW GUINEA

South American Maize Rust: Since 1955, twelve collections of maize rust have been made in the Territory of Papua and New Guinea: 5 of Puccinia sorghi (including 2 with teleutospores), all from inland, high-altitude areas, and 7 of P. polysora (uredospores only), all from the coastal region. Collections of both species were heavily parasitized by Eudarluca australis. The identifications have been confirmed at C. M. I. by F. C. Deighton.

The only previous record of maize rust from Papua and New Guinea was collected in 1936 by Mrs. Clemens and identified by Dr. G. B. Cummins (MYCOLOGIA (1941), 33: 416) as P. sorghi: Dr. Cummins has recently confirmed the identification of this collection which contains both uredo- and teleutospores.

Dorothy Shaw

NOTES FROM AFRICA

NORTHERN NIGERIA

A Leaf Gall Disease of Sorghum: Symptoms of a previously unrecorded disease of sugarcane were found on a sorghum plant at Shika in 1956, and in 1957 the disease was common at the Regional Research Station, Samaru, Zaria, 5 miles away. Most of the affected plants were of the locally grown variety Short Kaura, but other local varieties and some introduced varieties were also affected. The disease was first noticed on full grown plants: only the top parts of the plants showed symptoms, and infection must have taken place from about mid-season. Since harvest, similar symptoms have been found on tillers growing from stubble in several fields.

Upper part of a sorghum plant with leaf gall, showing the progressively shorter internodes and incomplete emergence of the head.

Symptoms

The general appearance of diseased plants is striking. Leaves and internodes formed after infection become progressively shorter; the leaves are slightly crumpled and stand stiffly in a crowded fan at the top of the plant, and the head which is poorly formed, emerges partially or not at all.

The galls occur on the midribs and veins on the underside of the leaf blades, on the veins of the leaf sheaths, and on the vascular tissues inside the stems, the latter galls being sometimes visible externally as thickenings of the veins. The galls, which are sometimes very numerous, are the same colour as the veins at first but become brown later: those on the leaf often show on the upper surface as yellow streaks. The largest galls are formed on the midribs and are up to 1 cm. long, 2.5 mm. broad and raised 2 mm. above the surface.

The only other record of a similar disease on sorghum appears to be that of Ocfemia and Celino, who, working in the Philippines, found a sorghum plant with long, narrow galls which closely resembled those of Fiji disease. The galls on diseased plants at Samaru differ from those of Fiji disease in external appearance but seem to be identical in origin and structure.

The abrupt appearance of the leaf gall disease at Samaru may be an indication of its ability to spread rapidly, in which case it will become of considerable importance in the future. It is hoped to study the disease more closely in 1958.

Specimens of galled leaves from the plant at Shika are in the C.M.I. herbarium (I.M.I. 70075).

Reference

Ocfemia, G.O. & Celino, M.S. (1955) Philipp. Agric., 38, pp. 558-9.

Elizabeth Harris

NYASALAND

Stem Disease of Coffee: Shortly after I came back from East Africa, I found Riley's (C.P. NEWS, April 1957, p. 29) stem pitting disease on coffee on one of our experimental stations. It has so far occurred only in a variety trial at this station, and only 3 varieties, all from Tanganyika, are affected: these trees look very unthrifty, with chlorotic leaves and some die back. On peeling away the bark one finds necrotic streaks in the cambium and/or phloem, but no necrosis of the wood. There is a certain amount of stem pitting also, but this appears to be localised in streaks which coincide with the necrotic strips of phloem. There is a considerable amount of stem distortion, also, giving the lower parts of the trees what I can only call a "gnarled" appearance. I have not yet seen any showing marked "bottling" of the stem, though this symptom may yet appear. The experiment in which this has occurred was planted in December, 1953, and in 1957 the 3 varieties which are affected by the disease were the lowest yielders. At no time has BHC been applied to these trees. The affected trees have been removed and destroyed.

D.C.M. Corbett

NEWS FROM INDIA

A survey of the coniferous forests in the Himalayas between 8,000 - 10,000 ft. at Lower Bashahr Division, Himachal Pradesh State, during June 1958, revealed:

Fomes pini on Blue Pine: A heavy attack of blue pine (Pinus excelsa) by F. pini was observed, particularly in forests situated near the villages where the trees were lopped heavily. Lopping of blue pine is a concession to villagers, who use the needles for spreading on the floors of cattle sheds, to be later used for making compost. Lopping is also done to allow sunlight in the surrounding land put under agriculture. Lopping which is intended to be restricted to the basal part of the tree, became uncontrolled in most cases, with the result that nearly all side branches were lopped. Infection occurred through these injuries. Numerous sporophores of F. pini appeared at all heights of the tree.

(continued from p. 56)

disease of ryegrass in New Zealand.

Dr. E. G. Brown has been appointed lecturer in botany at the University of Swansea.

Professor Lily Newton is retiring from the Chair of Botany at the University College of Wales, Aberystwyth, and will be succeeded by Dr. P. F. Wareing of the University of Manchester.

Rusts: The rust of blue pine, Coleosporium barclayense, with pycnia and aecia on needles, was common. The stem rust, Cronartium ribicola, said to occur on blue pine, was not observed.

Chrysomyxa deformans, a microcylic rust was common on spruce (Picea morinda). The telia occupied four continuous flattened beds along the length of the needle, nearly covering its tissues. The rust attacked current year's shoots only, in which all needles were attacked. The affected shoots could be noticed from long distances due to their turmeric yellow colour.

Chrysomyxa piceae, a doubtful species on P. morinda, developed telia on the needles. The telia were separate, scarlet red and waxy. Only a few needles were attacked. The rust appeared to be uncommon in the locality.

Mycorrhiza: Ectotrophic mycorrhiza was observed in blue pine where the mother root exhibited repeated dichotomy to finally end in short roots, which developed the fungus mantle on the surface and Hartig net in the cortical cells.

Endotrophic mycorrhiza was found in Taxus baccata, in which the feeder roots carried intracellular infection in the cortical cells. In their limited growth the feeders appeared like the short roots.

B.K. Bakshi

Emulsion Sprays against Leaf Spot Disease of Bananas

Since 1954, leaf spot disease, Mycosphaerella musicola, has caused much concern in the Southern Cameroons. Some 13,000 acres of the Corporation's bananas are sprayed from fixed wing aircraft, using rotary atomisers applying 1 g.p.a. of oil, and tractor drawn Giraffe machines applying a water-based copper fungicide at 2 g.p.a. But there still remain small isolated areas that do not lend themselves to control by either of these methods.

Such areas of diseased bananas in the Caribbean are controlled by the use of motor driven knapsack machines applying about 1 gallon of pure oil per acre, but reports of phytotoxicity suggested that improvements in the technique were desirable. To reduce the amount of oil would reduce toxicity but also reduce the coverage, and to maintain such coverage would require an oil of lower viscosity than was obtainable at that time.

It seemed that the best compromise lay in applying a small enough amount of oil to control the disease without causing phytotoxic symptoms and to make up the balance of liquid required for good coverage by the addition of water. The emulsion chosen contained 60 per cent. oil, which after shaking did not break for about 20 minutes (the time required to spray one tankful). Triton X 114 or ethylan CP have been used as emulsifiers. The 75 cc. machine made by Kiekens has been found most suitable, because the operator is able to shake the fluid tank on his chest occasionally to prevent the emulsion separating out.

This method has proved most satisfactory since April 1957 when it was introduced.

Plant Pathologist, David Price
Cameroons Development Corporation.

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